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# Advanced Procedure Research Study
# Applying Human Factor Principles to Procedure Presentation and Design

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## ABSTRACT

Well written procedures are an integral part of any industrial operation for safe operation, managing risks and continuous improvement. Although the importance of procedures is recognized by all industries and regulators, significant and costly incidents still occur due to procedural breakdown at several levels. This groundbreaking study goal is to develop a more effective procedure framework and best practices based on human factored research and technology initiatives.

## 1. ADVANCED PROCEDURE RESEARCH STUDY MEMBERS

The objective of the groundbreaking Advanced Procedure Research Study being conducted by the Mary Kay O'Connor Process Safety Center and Environmental and Occupational Health Department at Texas A&M University, is to develop an effective procedure framework for the process industry and identify best practices based on human factored research. Contributing members of the study include ATR, Chevron, ExxonMobil, NOVA Chemicals, Petrofac, Deloitte and NASA. Principal investigators are Dr. Sam Mannan and Dr. Camille Peres.

## 2. BACKGROUND

According to the Abnormal Situation Management Consortium, $50 billion per year in preventable human-caused incidents occur in the United States alone. Given that 70% of these are directly attributable to human error, and that 70% of those human errors are a direct result of challenges associated with inadequate procedures, there arises an opportunity to confront procedure challenges by analyzing the human factors associated with plant operations.

The need for a Human Factor paradigm in procedure development becomes more apparent when the sheer volume of activities in an organization may lead those tasked with writing effective procedures to provide sufficient levels of detail in only the simplest of situations - despite the robust amount of best practice guides and other documentation on designing effective procedures which are readily available in academic, government, trade group, and private sector arenas.

In virtually all conventional procedure programs studied, regardless of industry, there are 3 consistent limiting factors, which inherently put significant constraints on procedure effectiveness:

1. Procedure output is "one size fits all", regardless of individual needs, experience or knowledge

2. Procedure content is designed to output to paper format only

3. Guidelines are often based on "tribal knowledge" and opinion and "what we've always done" versus human factor-based empirical science

It is often found that procedure design is focused on being thorough in the quantity of information relayed in the procedure as opposed to the quality and true human-centric effectiveness of the information being conveyed in the procedure or the circumstances in which the procedure is being executed. While the "one-size-fits-all" quantity approach would work in a highly homogenized environment where all personnel are of similar (or exact) background, education, reading skill level and demographic, the fact remains the modern workforce is far too diverse for such an antiquated approach.

While current academic literature on the topic often focuses on studies after an incident, or on specific analysis on warning labels and instructions as tied to memory retention or design, a clear gap exists that ties all of these challenges and problems together - a gap which can be filled by addressing the Human Factor paradigm in procedure development.

Such a Human Factor paradigm will: (1) link the work that people do to (2) the capability and constraints of the people doing said work, given (3) the environment in which the work is being done. This three-tier Human Factor approach will fill the knowledge gaps and allow the industry to bridge divides created by all the divergent and convergent studies performed while adding a dynamic layer of discussion to procedure technology at large.

## 3. OBJECTIVES

Outputs from a human factored research framework will result in a systematic procedure development approach: maturing theoretical concepts into empirical solutions that will provide the process industry with the ability to effortlessly link specific procedures to certain tasks and functions which are often influenced by other related procedure or task executables (e.g., how execution of a routine maintenance task will be impacted by a change in the larger procedure or vice-versa).

Likewise, through this human factored research framework, the study will be used to enhance procedure technology so that the outputs of the procedure - be it on paper, a tablet, touchscreen, heads-up display, control room or any number of devices or mediums - will result in operator workflow being executed within the context of reducing human error, maximizing safety, and achieving zero incidents.

Enhanced procedure technology will also reward the process industry with new best practice guides, rules and methods for analyzing current procedures and how best to optimize those procedures to be in line with those best practices, and thus achieving the ultimate objective of saving lives.

## 4. PROCEDURE PROCESS

Part of the study goals are to identify all significant elements of a procedure development process contributing to its success or failure. Eleven critical elements of a procedure program have been identified:

1. Regulations and driving forces
2. Executive leadership
3. Governance
4. Procedure program administration
5. Authoring, review and management tools
6. Writing
7. Review and approval
8. Training
9. Culture
10. Usage
11. Continuous improvement – Management of change

Although not conclusive, a survey performed by Human Reliability Associates Ltd, involving 400 operators and managers in a particular industry reveals the complexities and attitudes associated with operators using or not using written procedures to perform their daily tasks. Table 1 provides results of this survey.

**TABLE 1**

**Survey on Why Procedures Aren't Used**

| | **Procedures are not used because:** | **% Respondents Agreeing** |
|---|---|---|

| | | |
|---|---|---|
| **Accuracy** | …they are inaccurate | **21%** |
| | …they are out-of-date | **45%** |
| **Practicality** | …they are unworkable in practice | **40%** |
| | …they make it more difficult to do the work | **42%** |
| | …they are too restrictive | **48%** |
| | …too time consuming | **44%** |
| | …if they were followed to the letter, they could not get done in time | **62%** |
| **Optimization** | …people usually find a better way to do the job | **42%** |
| | …they do not describe the best way to carry out the job | **48%** |
| **Presentation** | …it is difficult to know which is the right procedure | **32%** |
| | …they are too complex and difficult to use | **42%** |
| | …it is difficult to find the information you need in the procedure | **48%** |
| **Accessibility** | …it is difficult to locate the right procedure | **50%** |
| | …people are not aware that a procedure exists for the job they are doing | **57%** |
| **Policy** | …people do not understand why they are necessary | **40%** |
| | …no clear policy on when they should be used | **37%** |
| **Usage** | …experienced people don't need them | **19%** |
| | …people resent being told on how to do their job | **34%** |
| | …people prefer to rely on their own skills and experience | **72%** |
| | …people assume they know what is in the procedure | **70%** |

Source: "Preventing Human Error: Developing a Consensus Led Safety Culture Based on Best Practice, David Embry, Human Reliability Associates, LtD.

## 5. METHODOLOGY

The Advanced Procedure Research Study has been divided into four Phases, with activities in each Phase designed to meet specific information and solution goals that focus on the larger objectives.

- **Phase 1** will
  - identify current best practices of procedure writing,
  - analyze a sample of current procedures across industries, roles, and types, and
  - review a wide array of procedure templates and the content delivery / medium of those templates
  - review procedure regulations across

- **Phase 2** activities will generate solutions to solve the questions on how procedures should be designed and implemented to facilitate maximum operator safety, efficiency, and effectiveness, including:
  - identify critical issues that need to be addressed to bring about the desired results in safety, efficiency, and effectiveness through inquiries, workforce surveys, focus groups, and contextual as well as structured interviews
  - identify key items that must be addressed to resolve said critical issues and how to focus the investigative research to achieve real and actionable resolution.

- **Phase 3** will focus on the usability aspect of procedures in the human factor framework, and thus work to drill-down steps to identify resolutions and solutions for critical issues by conducting empirical research which identifies solutions and measurable benefits of employing said solutions. This will be achieved by:
  - developing protocols for addressing which issues are critical
  - conducting empirical studies
  - integrating study results into analysis of rules from the human factor procedure framework
  - evaluating a sample set of procedures built from the analysis rules conducted.

- **Phase 4** will be the actual of application of the procedure framework for the process industry - with immediate application to the partners who are funding and actively participating with ATR and the Mary Kay O'Connor Process Safety Center at Texas A&M University.

## 6. IMPLICATIONS

The Advanced Procedure Research Study will serve as a foundation by which to begin the real discussion of the Human Factor into designing a procedure; as opposed to merely thinking of Human Factor as a design element in a console, or the color of a button on a control panel, or as just an ergonomic issue, or even as just what font the warning label should be.

This weaving of a Human Factor framework into the procedure tapestry means bringing all elements into the sum total of consideration: the work being performed, the capability of the persons involved, and the operational environment of where the person is when they perform said work. Such a holistic consideration will have a positive implication on the core principles and values of best practices for procedure technology.

Consider that as a result of this study lies the opportunity for every person on the value chain in the process industry (from operator to engineer, and from maintenance technician to C-Suite) to

work flawlessly in any multimedia modality that optimally works for who they are, where they are, and towards what they are doing - ultimately saving time, treasure, and most importantly, lives.

From both a user and technology perspective, FIGURE 1 shows the difference between the status quo and potential opportunities offered through advanced technological solutions, such as ATR's SmartProcedures application.

## Figure 1

### Moving Paradigm from Writers to Operators